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(12) **EUROPEAN PATENT APPLICATION**

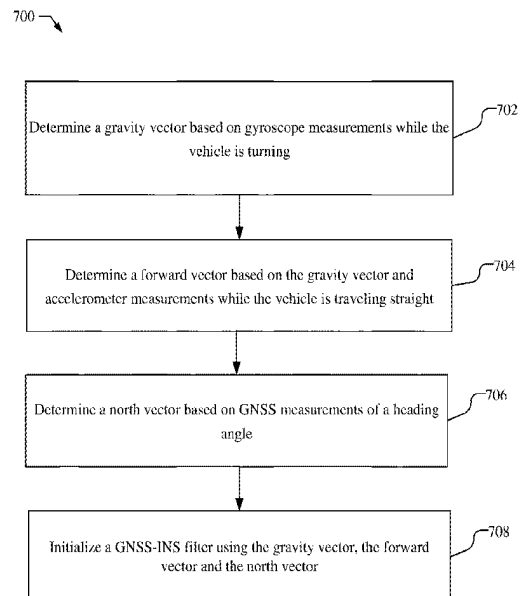
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(54) **METHOD AND APPARATUS FOR IN MOTION INITIALIZATION OF GLOBAL NAVIGATION SATELLITE SYSTEM - INERTIAL NAVIGATION SYSTEM**

(57) A mobile device in a moving vehicle initializes a Global Navigation Satellite System (GNSS)- Inertial Navigation System (INS) system while the vehicle is in-motion with the orientation of the mobile device with respect to a global reference frame. The mobile device uses gyroscope measurements made while the vehicle is turning to determine a gravity vector. The gravity vector and accelerometer measurements may be used to determine a forward vector for the mobile device. A north vector is determined using the GNSS measurements. After the GNSS-INS system is calibrated, the mobile device may be positioned with respect to the vehicle. The orientation of the mobile device, prior to repositioning, may be compared to a current orientation, determined while the vehicle is in motion, in order to determine whether the GNSS-INS system should be re-initialized.



**FIG. 7**

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EUROPEAN SEARCH REPORT

Application Number

EP 23 18 8041

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	<p>WAHLSTROM JOHAN ET AL: "IMU alignment for smartphone-based automotive navigation", 2015 18TH INTERNATIONAL CONFERENCE ON INFORMATION FUSION (FUSION), ISIF, 6 July 2015 (2015-07-06), pages 1437-1443, XP033204855,                      * abstract *                      * figure 1 *                      * I. Introduction *                      * II. Problem formulation *</p>	1-14	INV. G01C25/00
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
<b>The Hague</b>		<b>6 October 2023</b>	<b>Toth, Rémy</b>
CATEGORY OF CITED DOCUMENTS		<p>T : theory or principle underlying the invention                      E : earlier patent document, but published on, or after the filing date                      D : document cited in the application                      L : document cited for other reasons                      .....                      &amp; : member of the same patent family, corresponding document</p>	
<p>X : particularly relevant if taken alone                      Y : particularly relevant if combined with another document of the same category                      A : technological background                      O : non-written disclosure                      P : intermediate document</p>			

1 EPO FORM 1503 03.82 (F04C01)



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Place of search <b>The Hague</b>		Date of completion of the search <b>6 October 2023</b>	Examiner <b>Toth, Rémy</b>
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

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ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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